Joint Reliability Plan
R.14-02-001
Track Two Workshop

California Public Utilities Commission

David Miller

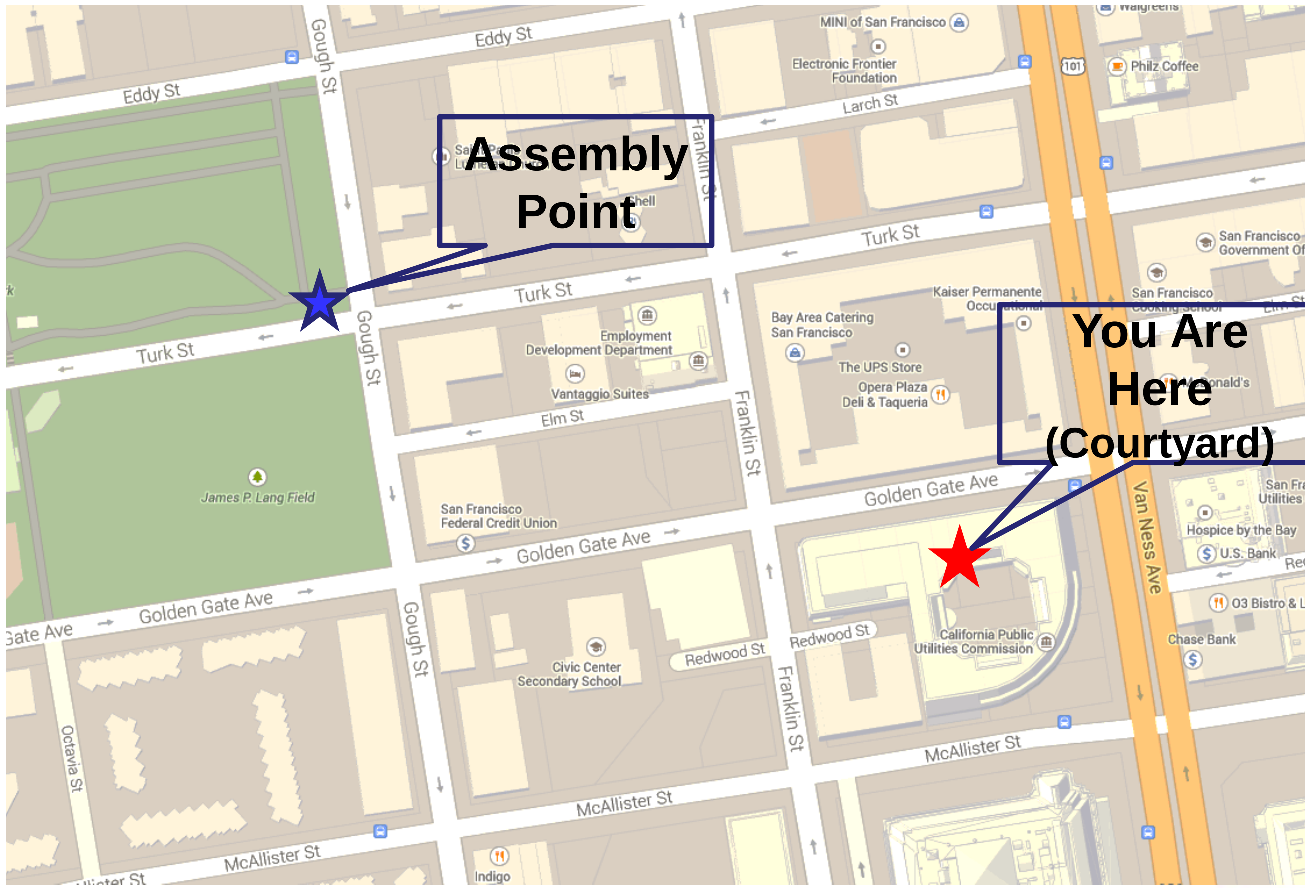
Energy Division

April 9, 2015

Evacuation Procedure

In the event of an emergency evacuation, please calmly proceed out the nearest exit.

★ Our assembly point is Jefferson Square Park on Turk and Gough Streets.



Remote Access

- Please place yourself on mute, and remain on mute unless you are asking a question
- **To mute / unmute press *6**
- ***PLEASE DO NOT PUT YOUR LINE ON HOLD!***

April 9, 2015 **9:30 am – 4:30 pm**	**To join by phone:** **Teleconference number: 866-778-0461** **Participant code: 3664376** **WebEx information:** **Meeting Number: 744 101 117** **Meeting Password: !Energy1** **To start or join the online meeting:** **Go to:** **https://van.webex.com/van/j.php?MTID=m904f21d13ebc3740d034e5cfb4ca1c9e**

What Question Do We Want To Answer?

Will unplanned resource retirements occur, and if so, are these retirements consistent with maintaining grid reliability?

Goals of This Proposal

Goal 1: Provide information to market as well as regulators to increase the likelihood that valuable resources will continue to contribute to grid reliability.

Goal 2: Develop a framework for evaluating the availability of generation resources to reliably meet load looking forward from one to ten years

Objectives of This Workshop

- Parties understand proposed approach
- Solicit feedback
- Refine approach to inform future staff proposal

Agenda

9:30a - 10:15	**Introductions, Overview of JRP Proceeding, Background on Track 2** *David Miller, Meredith Younghein, CPUC*
10:15 - 10:45	**Forward Needs and Supply Database Presentation** *David Miller, CPUC, Mike Jaske, CEC*
10:45 - Noon	***Discussion of Forward Needs and Supply Database Proposal***
Noon - 1:00p	**LUNCH**
1:00 - 2:30	**Economic Risk of Retirement Model Presentation** *David Miller, CPUC*
2:30 - 2:45	**BREAK**
2:45 - 4:30	***Discussion of Economic Risk of Retirement Model Proposal***
4:30p	**ADJOURN**

Policy Background

- JRP OIR opened February 2014
  - Purpose: “to consider policy proposals to refine California’s existing reliability framework for electricity procurement,”
  - “ensure that California’s electric reliability framework continues to adapt as needed to meet the changing requirements of the electric grid”
- Recognition that existing procurement framework may be insufficient to prevent resource retirements
  - Resource Adequacy (RA): One Year Ahead
  - Long Term Procurement Plan (LTPP): Year Ten
  - CPUC needs to remain “responsive”

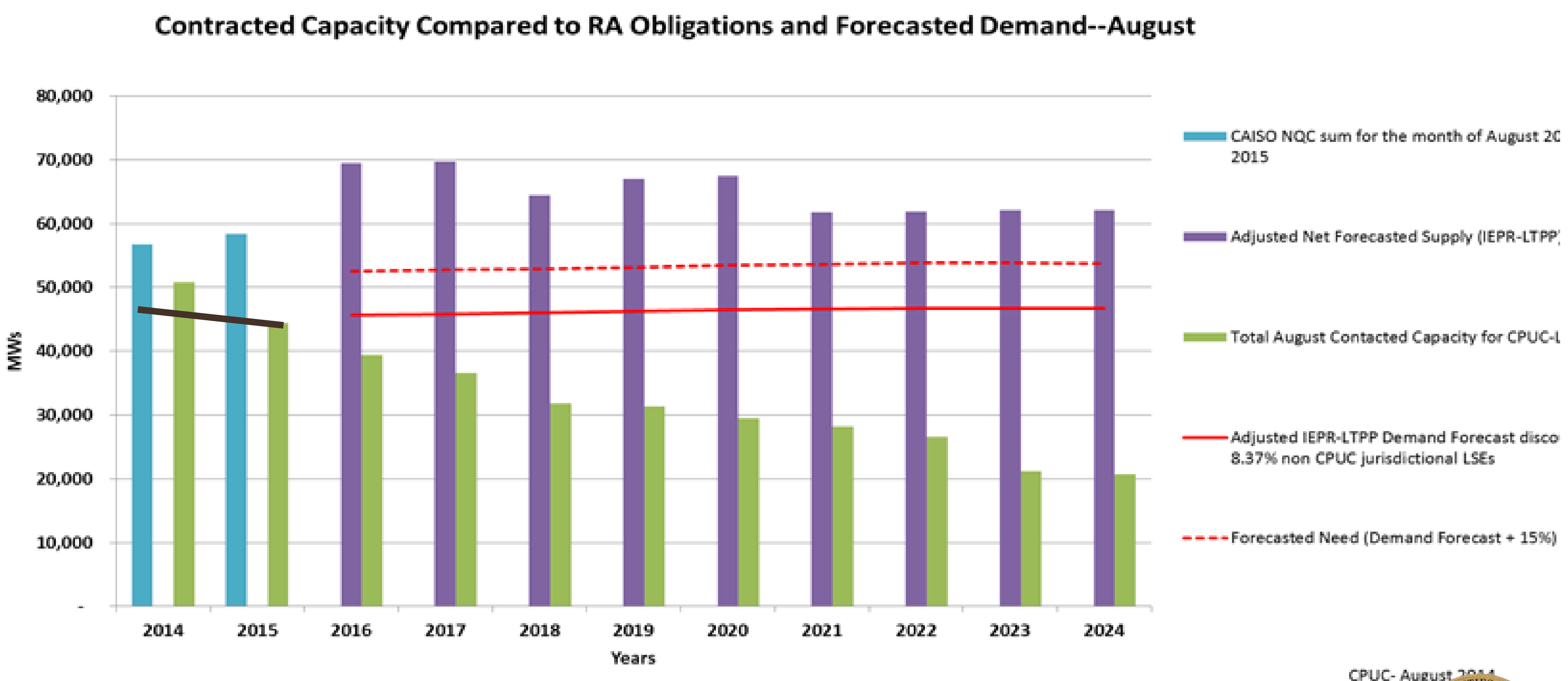
Track One Staff Report

- Released October 2014, extensive party comment received:
  - Party comment led to decision to suspend Track 1 and focus on flexible RA development in the RA proceeding
- Focus of Staff Report:
  - Discussed sufficiency & components of reliability framework, including availability of flexible resources
  - Proposed “Risk of Inefficient Retirement” terminology and Definition
  - Shared preliminary data on forward contracting
  - Proposed options for Multi-year RA requirements for system, local, and flexible capacity

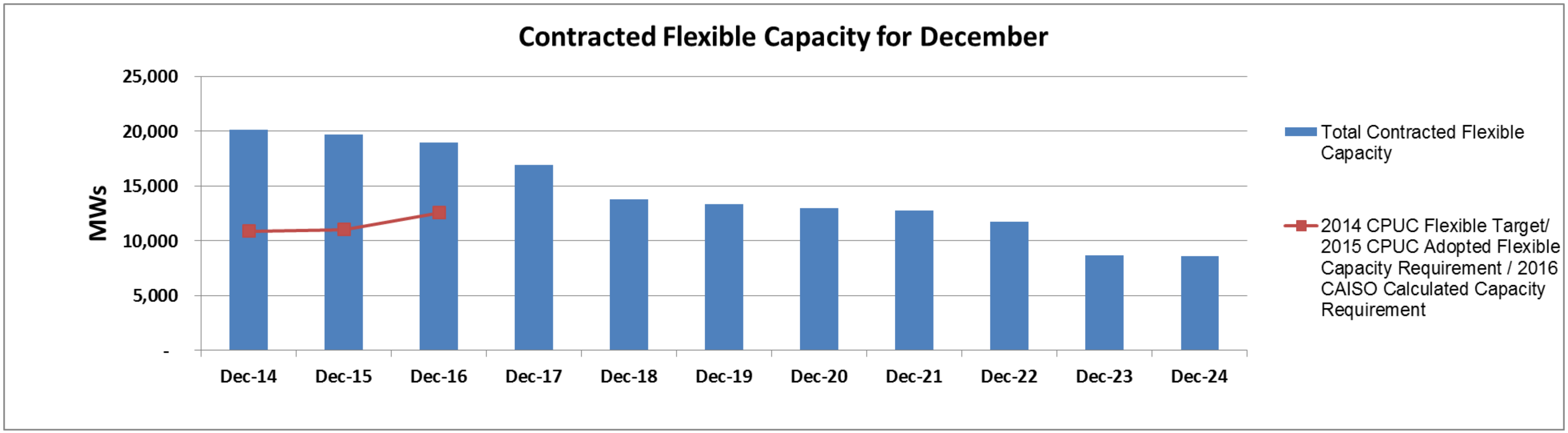
Track One Staff Report Cont…

- “The elements that form the present reliability framework are: the RA program, the LTPP program, utility procurement (portfolio management-as reviewed by CPUC), the CAISO Reliability Must Run (RMR) program, and CAISO’s backstop authority (the Capacity Procurement Mechanism or CPM).”
- “The Commission needs to consider whether the existing framework can adapt to future system needs and whether generation resources will be available to meet those needs.”
- “evidence is not presently available which suggests that the current generation fleet cannot meet the system’s highest possible demand for flexibility.”

Staff Report: Data on Forward Contracting-System RA



Data on Forward Contracting-Flexible RA



State of the Grid

The CA Electric Grid is in a State of Evolution

- California's installed capacity exceeds expected load by 40%
- This surplus capacity should ensure reliability in the near term
- However:
  - Surplus may place financial pressure on resources at risk of retirement
  - Changes in net load shape creating additional system needs

Rapid reversal of this current long position?

- ***Near Term***
  - Increasing renewable penetration creating a need for an increasingly flexible resource stack
  - Decreasing marginal energy prices placing downward financial pressure on existing conventional resources
- ***Long term***
  - Planned OTC retirements will thin out the existing conventional fleet, increasing importance of those remaining conventional resources that have sufficiently flexible capabilities.

JRP Track Two Proposal

1. Develop Forward Needs and Supply Database
   - Load Forecast
   - Available Supply
   - Contracted Resources
2. Develop Economic Risk of Retirement Model (ERORM)
   - Develop framework for forecasting whether inefficient retirements will occur
   - Stochastically forecast generator profitability
   - If generator is not profitable *AND* it is crucial for system reliability *THEN* it is at risk of inefficient retirement

Inefficient Retirement Definition

“Whether a resource is determined to be at risk of inefficiently retiring is dependent upon a factor test, which encompasses both the valuable attributes of the resource and its financial situation.”

Factor Test Definition

A resource is economically stressed if one of the following is true:

1. Unable to operate at a profit in the next five years
2. Unable to make upgrades necessary to continue operating
3. Unable to make upgrades necessary to operate in a way that provides an essential service to the grid

An economically stressed resource is at risk of inefficient retirement if both of the following are true:

A. Resource is valuable – it has unique characteristics, such as
   - Critical to local reliability needs
   - It is flexible

B. No other resource can sufficiently provide these valuable services. (Not easily replaceable)

Forward Needs and Supply Database

Forward Needs and Supply Database

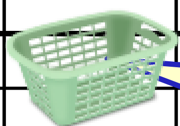
- Transparently collect, maintain and share this information
  - Institutionalize this process
  - Perform / update at regular intervals

- Database Contains:
  - System, local and flexible quantities

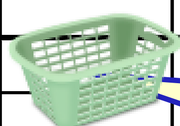
- Database Components:
  - Load forecast (includes DG and EE)
  - Available supply (Physical, DR, Storage)
  - Contracted resources

Forward Needs and Supply Database

Database	Type	2016	2017	2018	. . .	2024	2025	2026
Load	System							
	Flexible							
	Local - A							
	Local - B							
	Local - C							
Supply	System							
	Flexible							
	Local - A							
	Local - B							
	Local - C							
Contract	System							
	Flexible							
	Local - A							
	Local - B							
	Local - C							



Specify ALL supply resources



Specify ALL contracted resources

RA

LTPP

Load Forecast Database

- Based on IEPR forecast for CA
- Adjustment factor needed to correct for the percentage of CAISO-system load captured within CEC load forecast that is not CPUC jurisdictional
  - Required because the CAISO-system includes some municipal utilities that are not CPUC jurisdictional.
  - Additional complications due to departing load
  - Not relevant for modeling work
- Correction factor was developed with CEC for JRP Track One Staff Report

CEC Presentation on IEPR Load Forecast and Local Capacity Assessment

Available Supply Database

- Capture all supply resources in the fleet on a year-by-year basis out ten years
  - Physical generation, DR and storage assets
- Matches LTPP forecast in year 10
- Difference between LTPP authorizations and CPUC-approved additions reflects a deficit
  - Need to include proxy for deficit

LTPP Scenario Tool

- LTPP Scenario Tool describes physical stack of resources vs. forecast load through 10 years forward (i.e. 2015-2024).
- Used for generating scenarios of load and resource forecasts built upon planning assumptions jointly developed by staff at the CPUC, the CEC, and the CAISO.

LTPP Scenario Tool

Resource additions based on:

- Projects with:
  - CPUC Approved contract (PPA)
  - CEC Permitted
  - Begun construction
- Existing LTPP procurement authorizations (supplemented by Applications filed with CPUC)
- Other CPUC procurement authorizations
  - For example Storage, RPS

LTPP Scenario Tool

Scenario tool can select low / medium / high age based retirement assumptions by technology type

Technology	Retirement
Solar	25 years
Wind	25 years
Non Hydro Renewables	40 years
Hydro	70 years
Nuclear	Assumed to get renewal and operate beyond 2025
OTC	By SWRCB compliance date
Other Facilities	40 years, unless contracts go beyond

http://docs.cpuc.ca.gov/SearchRes.aspx?docformat=ALL&docid=147780118

Contracted Resources Database

- Captures information about resources under contract
- JRP Track One Staff report included information from first draft
- Staff has developed a new data request template and is requesting feedback from parties
- ***Is sufficient information requested?***

Discussion of Supply and Needs Database

Load Forecast Database Questions

- **Adjusting Load Factor**
  - Obtaining future needs based on CEC IEPR forecast is complicated by the need to disaggregate CEC and CAISO forecasts to reflect CPUC jurisdictional LSEs. If the CEC IEPR forecast is used to assess future needs, how should this disaggregation be performed?

Available Supply Database Questions

- **LTPP Deficit**
  - The difference between LTPP authorizations and CPUC-approved additions reflects an expected future deficit. How can we account for this deficit consistent with LTPP?
  - With what spatial / temporal granularity?
  - Should the study be tied to the LTPP or use new information as it comes in?

- **Data availability**
  - Is any formal data request needed to capture information related to available supply or retirements occurring by year within the next ten years?

Contracted Resources Database Questions

- **Template**
  - Does the proposed template sufficiently capture LSE contracting data?
  - Is any data missing, or could any data be collected more efficiently?
  - Are options to extend a contract used? If so, how can this information be captured?

Contracted Resources Database Template

- *Include information requested for each resource (conventional generation, wind, solar, DR or storage) that is owned, in whole or in part, by the LSE or under contractual commitment to the LSE for all or a portion of its capacity.*
- Do not need information about trading positions
- Not capturing pricing information

LSE Name	Resource ID	Contract ID	Resource Name	Contract Type

Unique ID

ContractType
IOU/LSE Owned
RA Only
RA + Other
Energy Only

Contracted Resources Database Template

LSE Name	Resource ID	Contract ID	Resource Name	Contract Type

Technology	Tech Other	CHP	OTC	QF	RPS	Namplate (MW)

2015_Mar_Enrgy	2015_Mar_Genrc	2015_Mar_Locl	2015_Mar_Flex

Contracted Resources Database Questions

- **Timing**
  - When is the ideal time each year to have CPUC staff collect the contracting data from CPUC-LSEs?
  - When should Staff release the annual update of the forward needs and supply database?
  - Should this request and reporting occur annually?
  - Is an additional off-schedule data request acceptable?

General Database Questions

- **Confidentiality**
  - – Which information in the proposed database should be made public and which should remain confidential?
  - – How should the CPUC report / aggregate information for local area resource contracting that accounts for confidentiality?
  - – CAISO already releases local generator information in their Local Capacity Technical Study

Lunch Break

Economic Risk of Retirement Model

Goals of This Proposal

Goal 1: Provide information to market as well as regulators to increase the likelihood that valuable resources will continue to contribute to grid reliability.

Goal 2: Develop a framework for evaluating the availability of generation resources to reliably meet load looking forward from one to ten years

Economic Risk of Retirement Model

- Framework for evaluating the likelihood of inefficient generator retirement.
- Based on:
  - Forward Needs and Supply Database
  - Stochastic modeling framework
    - Forecasts production costs and revenues
  - Mechanism for establishing whether a possible retirement is inefficient

Economic Risk of Retirement Model

- Stochastic calculation uses SERVM (Strategic Energy & Risk Valuation Model)
- This model being used nationally
- Also being used by PG&E in their CES-21 Study
- Treats detailed generator operational parameters
- Simplified transmission regions
  - Pipe and bubble

SERVM Stochastic Modeling

- 33 years of historical weather
- 5 years of historical weather and load data trains the model
- 33 years of synthetic load shapes
  - Preserves spatial and temporal correlation between load and weather
  - Wind and solar profiles based on historical weather profiles and available supply
- 5 load forecast error points
  - Load data is scaled by peak to target year forecast
- 50 Unit Performance Draws
  - Randomly draws from the time to fail and time to repair distributions to simulate a unit’s operation and downtime

SERVM Generator Information

- **Physical**
  - Pmin, Pmax
  - Startup times (hot, warm, cold)
  - Heat rate and ramp rate curves
- **Costs**
  - Startup costs (hot, warm, cold)
  - Variable O&M Costs
  - Fuel costs
  - Fuel transportation costs
  - Emissions costs (future)

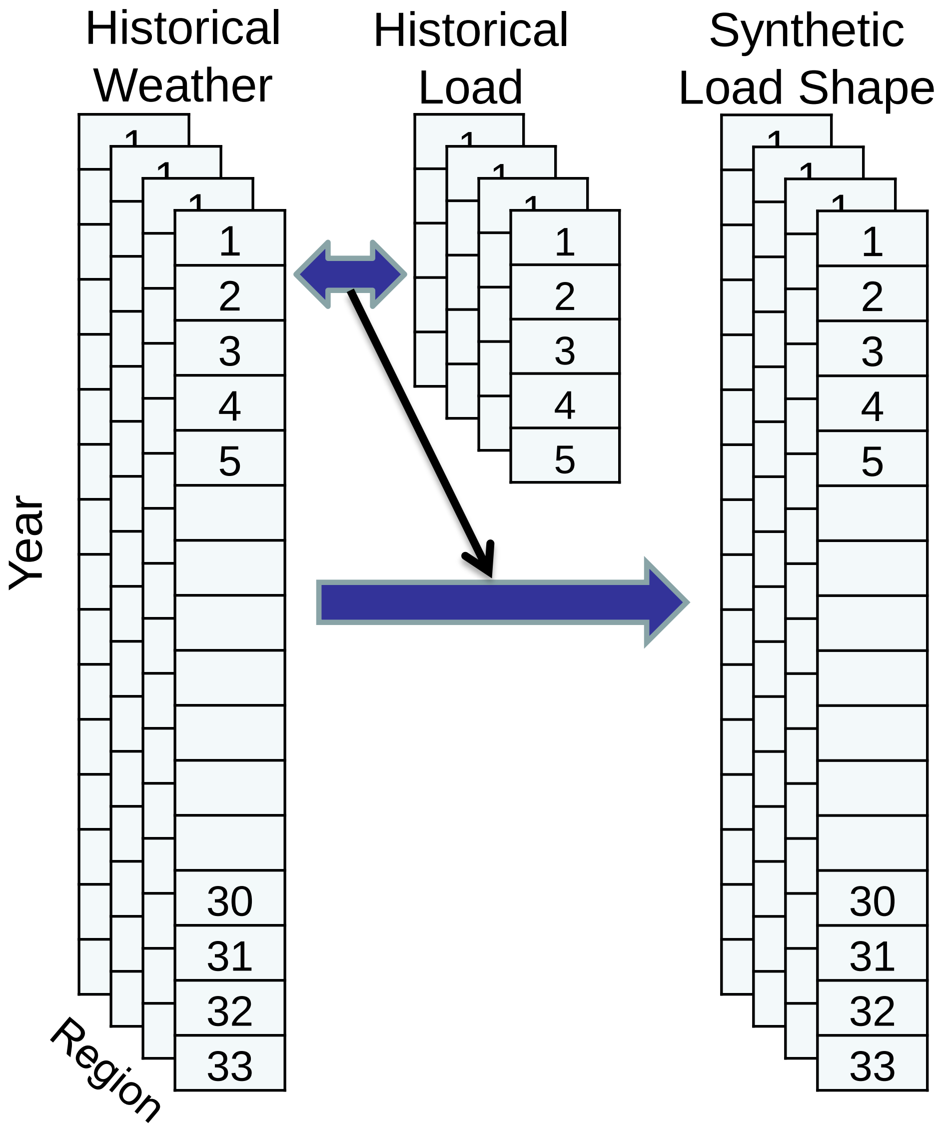
SERVM Generator Information

- **Outage**
  - Partial and full time to failure, repair
  - Generator maintenance
  - Startup failure rates
- **Data Sources**
  - CAISO generation informed by CAISO Master File
  - TEPPC Common Core informs generators outside CAISO

Other SERVM Details

- **Transmission modeling**
  - Utilizes pipe-and-bubble representation
  - Currently 17 interconnected regions within WECC
- **Gas Prices**
  - Forward NAMGAS price curves and fuel handling costs under a variety of planning assumptions, consistent with CEC forecasts.
- **Sub hourly resolution**
  - Ability to simulate on sub hourly time scales in order to capture operational flexibility needs
- **Forecast Errors**
  - Ability to capture forecast errors for load, solar and wind generation based on historical data.

Stochastic Inputs



- 33 Weather Years
- 17 Transmission Regions
- Load shapes scaled by peak load forecast for study target year

SERVM Output

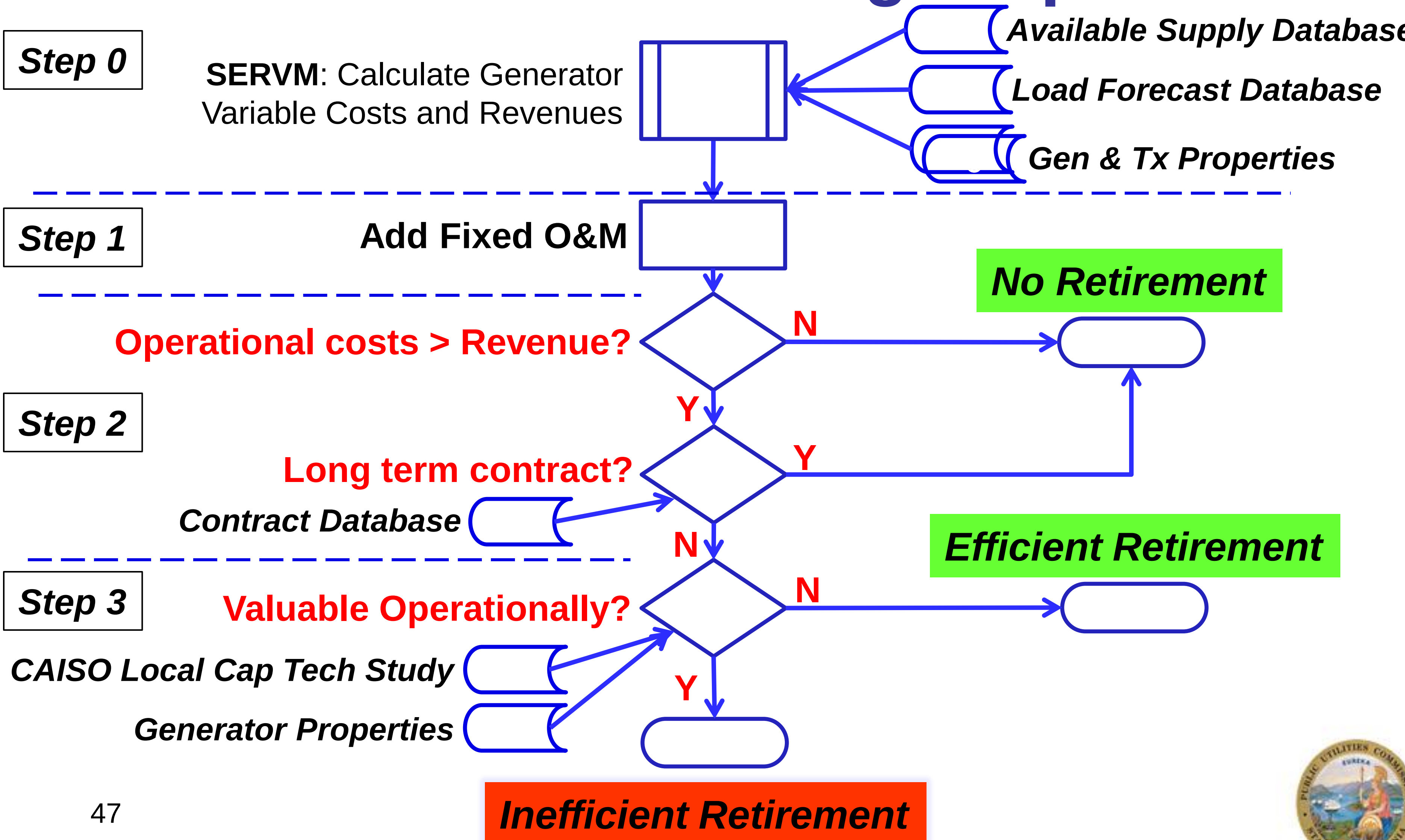
For each generator and target year:

- Case probability
- Annual or monthly
  - Variable production costs
  - Revenues
  - Fuel: quantity and costs
  - Starts / stops
  - EUE / LOLE

Economic Risk of Retirement Model

- SERVM stochastically forecasts variable production costs and revenues for each generator
- Three post processing steps required:
  1. Apply fixed costs
  2. Determine whether resource has contract
  3. Determine, if retirement, is inefficient

ERORM Processing Steps



Integration with Forward Needs and Supply Database

- Load Forecast and Available Supply databases inform SERVM stochastic modeling for each target year
- Contract Database informs determination of retirement
  - Existence of contract in study target year precludes retirement
  - ***Is this a valid assumption?***

Applying Fixed Costs

- CEC Cost of Generation model provides generator fixed costs
- Looks at Generator fixed costs across variety of technologies
- Accounts for:
  - Capital and Financing
  - Insurance
  - Ad Valorem
  - Fixed O&M
  - Taxes
- Statistically insignificant effect of age of generator on fixed costs
- Small effect of generator size on fixed costs
- Costs depend on ownership (Merchant, POU, IOU)
- Propose using Merchant financing costs

http://www.energy.ca.gov/2014publications/CEC-200-2014-003/index.html

Is a Retirement Inefficient?

- CAISO Local Capacity Technical Study examines generators critical for local reliability
  - Calculates effectiveness factors that demonstrate which generators can support local reliability
  - One, five and ten year forecasts developed
- ***How can we use CAISO LCTS to inform this process?***

Is a Retirement Inefficient?

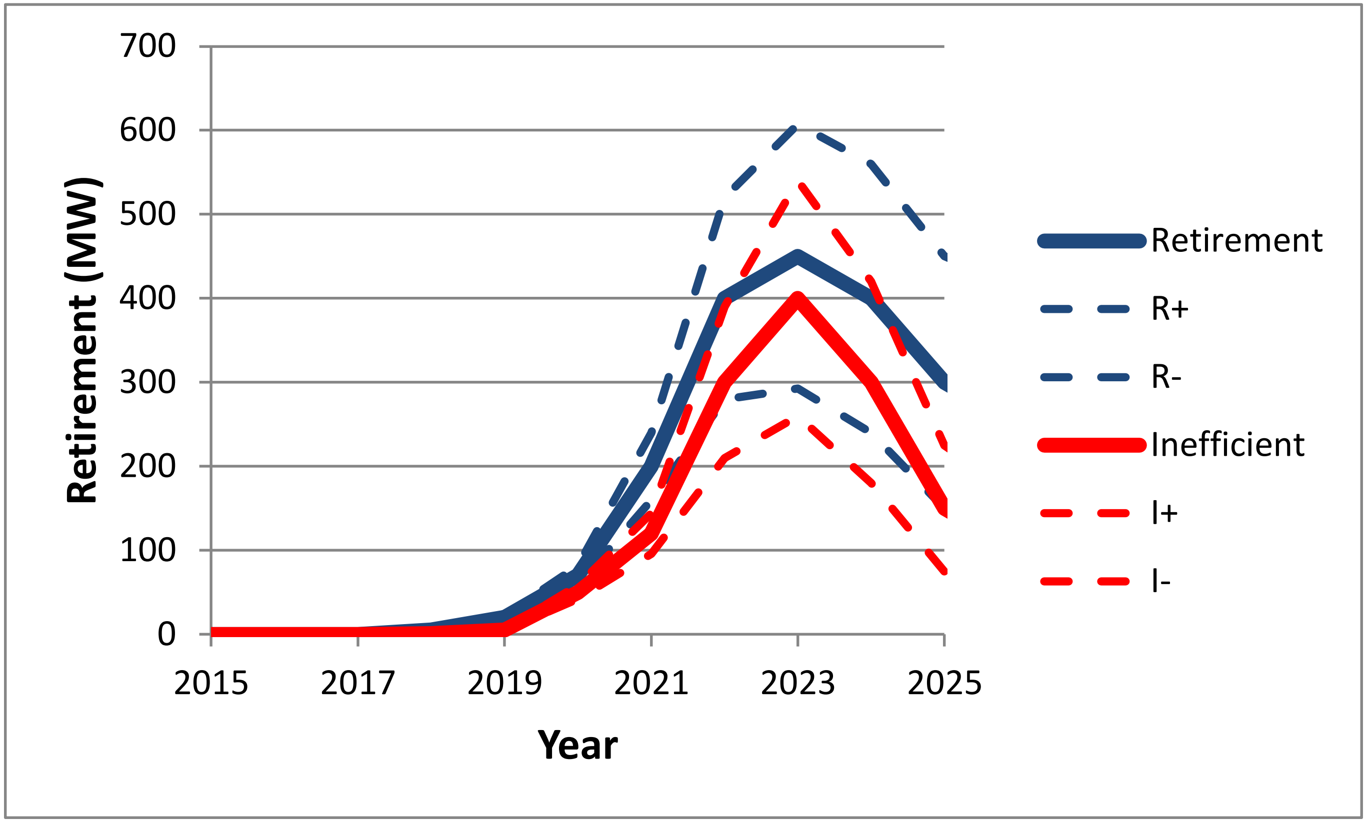
- Physical generator properties can also be used to inform this determination
  - Does generator have valuable physical attributes?
    - Fast ramping
    - Low Pmin
    - Short startup times
    - Valuable location
    - Age of plant
- ***Can we develop rules to capture value?***

Capturing Uncertainty

- Distribution of gross profits for each generator is stochastically captured by SERVM from spot market pricing
- Uncertainty in supply and load forecasts can be captured by running alternative scenarios
- Contract database does not capture any pricing information
  - *Model does not capture capacity revenues*

Schematic ERORM Output

- Generation at risk of inefficient retirement



Sensitivity Analysis and Benchmarking

- Risk of retirement will depend on supply stack and load forecast
  - How sensitive is MW at risk of efficient / inefficient retirement to uncertainty in supply stack / load forecast?
- Importance of location
  - ELCC studies finding increased importance of generators in SCE territory for reliability
  - Does location of generator impact risk of retirement?
- Which generators always run? Which generators only run in some cases?
- Benchmark our results against
  - CAISO studies
  - ORA risk of retirement study

Weakness in Approach

- Model uses gross profit to evaluate whether unit is at risk of retirement
  - *Ignores any profit margin requirement*
  - *Assumes resource is operated efficiently*
- The model assumes that the existence of a contract implies revenue sufficiency
  - *Model does not capture capacity revenues*

Discussion of Economic Risk of Retirement Model

ERORM Questions

- **Stochastic Inputs**
  - Are the stochastic inputs sufficient to capture expected uncertainties and variability?
- **Fixed O&M Costs**
  - What should be the basis for calculating fixed O&M costs?
- **Local Capacity Technical Studies**
  - CAISO Local Capacity Technical Studies examine the importance of generators for local reliability. How can results of the CAISO Local Capacity Technical studies be used to understand inefficient retirements?

ERORM Questions

- **Inefficient Retirements**
  - "Whether a resource is determined to be at risk of inefficiently retiring is dependent upon a factor test, which encompasses both the valuable attributes of the resource and its financial situation."
  - How can a factor test be developed to inform determination of inefficient retirement? What additional factors should be considered?
- **Sensitivity Studies and Benchmarking**
  - What sensitivity and benchmarking studies should be performed?

Thank You!

Please submit informal written comments on
***Joint Reliability Plan Track 2 Concept Paper and Workshop to*:**

David Miller, david.miller@cpuc.ca.gov , 415-703-1146

by April 23, 2015

www.cpuc.ca.gov

Appendix: Additional Slides

JRP Track Two Scoping Memo Questions

1. What process should the CPUC adopt for developing jointly-agreed-upon input assumptions or scenarios, methods for collecting data on forward contracts or ownership of units?
2. What methodology should the CPUC establish for completing forward planning assessments?
3. What is the appropriate forward planning horizon for the assessment?
4. What additional studies, conducted by the CPUC, CEC or CAISO may be necessary for an ongoing assessment at regularly established intervals?
5. Could establishing a procurement database enhance the efficiency of regularly conducting such assessments, the timing and time periods covered by such assessments, and confidentiality rules?
6. Should the CPUC establish a process for the State to conduct this type of planning assessment on a regular basis, and if so on what time interval?

JRP Scoping Memo

CEC Cost Of Generation Model

		$/kW-Year (Nominal 2013$)					
In-Service Year = 2013	**Size MW**	Capital & Financing	Insurance	Ad Valorem	Fixed O&M	Taxes	**Fixed Costs**
Generation Turbine 49.9 MW	49.9	150.78	10.33	14.98	35.51	43.68	**255.28**
Generation Turbine 100 MW	100	145.88	10.00	14.49	34.32	42.27	**246.96**
Generation Turbine - Advanced 200 MW	200	117.85	8.09	11.73	31.57	34.09	**203.32**
Combined Cycle - 2 CTs No Duct Firing 500 MW	500	122.53	8.26	11.98	43.23	40.49	**226.49**
Combined Cycle - 2 CTs With Duct Firing 550 MW	550	120.01	8.09	11.74	43.23	39.65	**222.72**
Biomass Fludized Bed Boiler 50 MW	50	435.03	37.08	54.69	131.18	-170.01	**487.96**
Geothermal Binary 30 MW	30	581.53	49.83	73.51	110.86	-230.42	**585.31**
Geothermal Flash 30 MW	30	634.79	54.38	80.22	110.86	-251.31	**628.93**
Solar Parabolic Trough W/O Storage 250 MW	250	361.56	15.94	25.81	87.75	-145.13	**345.93**
Solar Parabolic Trough With Storage 250 MW	250	514.10	22.69	6.68	87.75	-206.66	**424.57**
Solar Power Tower W/O Storage 100 MW	100	394.14	17.37	28.12	77.68	-157.80	**359.50**
Solar Power Tower With Storage 100 MW 6 HRs	100	548.45	24.19	7.12	81.93	-220.21	**441.48**
Solar Power Tower With Storage 100 MW 11 HRs	100	609.31	26.87	7.91	81.93	-244.47	**481.55**
Solar Photovoltaic (Thin Film) 100 MW	100	258.50	11.47	3.38	35.30	-105.36	**203.30**
Solar Photovoltaic (Single Axis) 100 MW	100	257.94	11.39	3.35	45.76	-103.93	**214.53**
Solar Photovoltaic (Thin Film) 20 MW	20	318.57	14.13	4.16	35.30	-129.60	**242.57**
Solar Photovoltaic (Single Axis) 20 MW	20	321.50	14.19	4.18	45.76	-129.29	**256.35**
Wind - Class 3 100 MW	100	244.48	21.05	30.76	39.44	-83.96	**251.76**
Wind - Class 4 100 MW	100	219.31	18.91	27.64	39.44	-78.03	**227.27**

[CEC Cost of New Renewable and Fossil Generation in California Final Staff Report]

Flexibility Categories

- **Flexibility Categories**
  - **(1) Base Flexibility**: Operational needs determined by the magnitude of the largest 3-hour secondary net-load10 ramp
  - **(2) Peak Flexibility**: Operational need determined by the difference between 95 percent of the maximum 3-hour net-load ramp and the largest 3-hour secondary net-load ramp
  - **(3) Super-Peak Flexibility:** Operational need determined by five percent of the maximum 3-hour net-load ramp of the month

- No limit to amount of resources that meet the “Base Flexibility”
- However, maximum amount of flexible capacity can come from resources that only meet the criteria to be counted under the “Peak Flexibility” or “Super-Peak Flexibility categories

[CAISO Final 2014 Flexible Capacity Needs Assessment]

Flexibility Use Limitations

	Category 1	Category 2	Category 3
Must-offer obligation	17 Hours	5 Hours	5 Hours
	5 AM- 10 PM Daily For the whole year	7 AM – 12 PM for May – September	7 AM – 12 PM for May – September
	5 AM- 10 PM Daily For the whole year	3 PM- 8 PM for January- April and October-December	3 PM- 8 PM for January- April and October-December
	Daily	Daily	Non-holiday weekdays
Energy limitation	At least 6 Hours	At least 3 Hours	At least 3 Hours
Starts	The minimum of two starts per day or the number of starts allowed by operational limits as determined by minimum up and down time	At least one start per day	Minimum 5 starts a month
Percentage of LSE portfolio of flexible resources	At least 68 % for May – September	Up to 32% for categories 2 and 3 combined	Up to 5%
	At least 74 % for January- April and October-December	Up to 26% for categories 2 and 3 combined	Up to 5%

2015 CPUC Final RA Guide